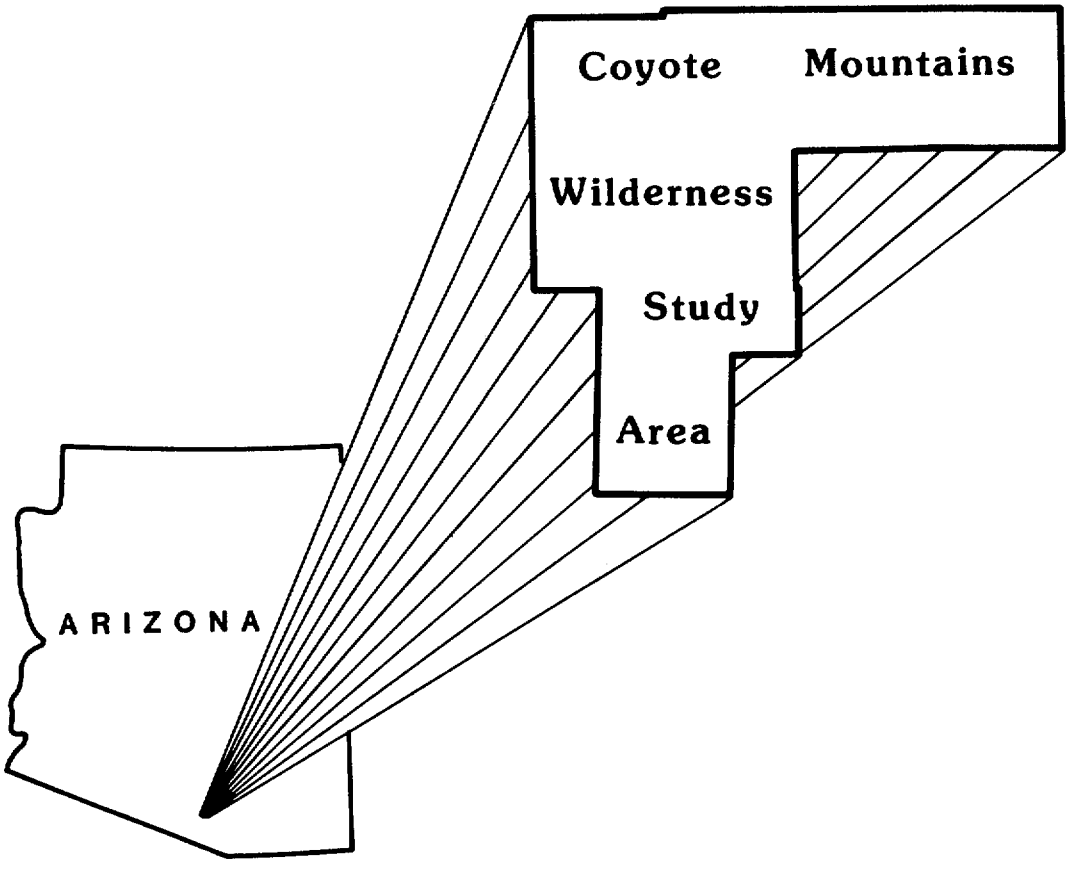
MLA 34-87

Mineral Land Assessment
Open File Report/1987

Mineral Resources of the Coyote Mountains Wilderness Study Area (AZ-020-202), Pima County, Arizona



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE COYOTE MOUNTAINS WILDERNESS STUDY AREA (AZ-020-202), PIMA COUNTY, ARIZONA

by

William Lundby

MLA 34-87
1987

Intermountain Field Operations Center
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Coyote Mountains Wilderness Study Area (AZ-020-202), Pima County, Arizona.

This open-file report summarizes the results of a Bureau of Mines wilderness study and will be incorporated in a joint report with the Geological Survey. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. Work on this study was conducted by personnel from the Branch of Mineral Land Assessment (MLA), Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS--Continued

TABLES

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

cu ft/t	cubic feet per ton
°	degree(s)
ft	foot, feet
in.	inch(es)
mi	mile(s)
m.y.b.p.	million years before present
ppm	part(s) per million
%	percent
lb	pound(s)
oz/st	troy ounces per short ton

MINERAL RESOURCES OF THE COYOTE MOUNTAINS WILDERNESS STUDY AREA (AZ-020-202), PIMA COUNTY, ARIZONA

by

William Lundby, Bureau of Mines

SUMMARY

The Coyote Mountains Wilderness Study Area, about 33 miles west-southwest of Tucson, Arizona, comprises 5,080 acres of land administered by the U.S. Bureau of Land Management.

Field work, done in April 1986, consisted of mapping and sampling mines and prospects and collecting stream-sediment samples in the area. A total of 26 field-days was spent in the study area by Bureau of Mines personnel. This study was done under the authority of the Federal Land Policy and Management Act of 1976 (Public Law 94-579).

The subeconomic mineral resources within the study area are estimated as 66,500 tons at a grade in excess of 5% copper, 1.5 oz silver/st, and 0.15% tungsten trioxide. This estimate is based on the correlation of Bureau of Mines sample data from underground workings and the results of data from earlier drilling. The mineral occurrences are in and at the margins of Devonian-age carbonate roof pendants that occur in intrusive granitic rocks. It may be possible to define additional resources by using geophysical techniques.

No resources of sand, gravel, or other industrial minerals are present within the study area.

INTRODUCTION

In April 1986, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), studied the mineral resources of the Coyote Mountains Wilderness Study Area (WSA), Pima County, Arizona, on lands

administered by the Bureau of Land Management (BLM). The Bureau surveys and studies mines, prospects, and mineralized areas to appraise reserves and identified subeconomic resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. This report presents the results of the Bureau of Mines study. The USGS will publish the results of its studies. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of both surveys.

Geographic setting

The Coyote Mountains WSA comprises 5,080 acres of land about 33 mi west-southwest of Tucson, Arizona. The study area is bounded on the north and west sides by Papago Indian tribal lands and on the south and east sides by State and private lands (pl. 1, fig. 1).

The WSA is in the Basin and Range physiographic province of southern Arizona. The topography varies from moderate to rugged and is virtually inaccessible at the crest of the Coyote Mountains. Elevations vary from about 3,000 ft at the northeast corner of the WSA to 6,529 ft at Coyote Peak, in the northwest part of the area. Vegetation consists of Arizona white oak, Mexican pinyon, mesquite, paloverde, ironwood, acacia, manzanita, mountain mahogany, buckthorn, silktassel, and several varieties of cactus and represents both Upper and Lower Sonoran life zones (U.S. Bureau of Land Management, 1984).

Access to the southern and eastern parts of the area is west from Tucson via Arizona State Highway 86 to Three Points (Robles Junction), a distance of about 22 mi, thence south about 8 mi on Arizona State Highway 286 to the Anvil Ranch road. Gravel roads and jeep trails provide access from the Anvil Ranch to Mendoza Canyon, White Rincon, and Mendoza Wash (pl. 1). If permission to

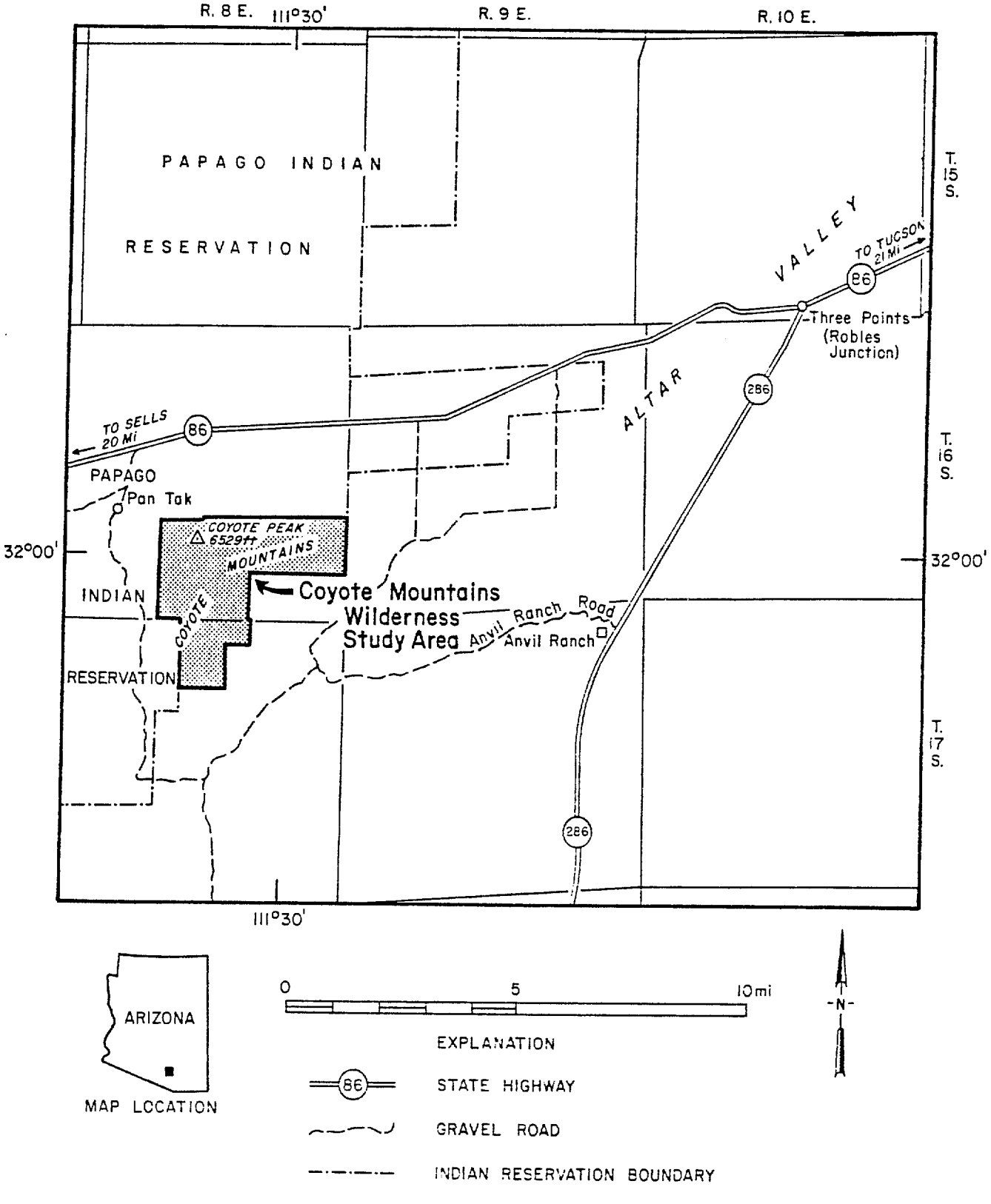


Figure 1.--Index map of the Coyote Mountains Wilderness Study Area, Pima County, Arizona.

cross Papago Indian lands can be obtained, access to the northern and western parts of the area is afforded via gravel roads and jeep trails from State Highway 86.

Previous investigations

General geology of the Coyote Mountains was mapped by Wargo (1954), Kurtz (1955), and Wargo and Kurtz (1956). A petrographic study of a part of the Coyote Mountains was done by Gardulski (1980), and Wright and Haxel (1982) reported on the Pan Tak Granite, a two-mica granite that underlies about half of the Coyote Mountains area. Haxel and others (1980) mapped and discussed the Mesozoic and lower Cenozoic rocks of the southern part of the Papago Indian Reservation, which is immediately adjacent to the WSA. Reports by Carpenter (Carpenter, M. M., 1926, Preliminary report: Unpublished report obtained from files of C. Caviness, Tucson, Arizona; 4 p.), Carrigan (1971), Hewitt (Hewitt, V. G., 1975, Induced polarization survey, Coyote Mountain project, Pima County, Arizona: Unpublished report in files of C. Caviness, Tucson, Arizona, 8 p.), and Caviness (Caviness, C. R., 1981, Yac Mine, Coyote Mountains, Pima County, Arizona; Unpublished report obtained from the files of C. Caviness, Tucson, Arizona, 2 p.) are concerned with the mineral occurrences and mine workings at Cavillo Camp in the north-central part of the study area. A geology, energy, and mineral resources assessment by Cruver and others (1982) included the Coyote Mountains WSA, as did an environmental report published by the BLM (1984).

Methods of investigation

A detailed literature search for pertinent geologic and mining information for the WSA was made by Bureau personnel prior to the field investigation. BLM and county records were examined for location of patented

and unpatented mining claims (pl. 1), mineral leases, and oil and gas leases in and near the study area.

The Bureau's field study concentrated on the examination of known mines, prospects, and mineralized areas inside or within 1 mi of the WSA boundary; peripheral mineral occurrences were examined to determine whether they might extend into, or are similar to those within, the study area. A total of 26 employee-days was spent in the area. Accessible mine and prospect workings were mapped, using compass and tape, and sampled. Chip samples were collected across veins and/or potentially mineralized structures; stream-sediment samples were collected from some of the drainages to aid in the evaluation of the extent of the exposed mineral occurrences and to help identify additional occurrences within the drainages.

A total of 34 samples was collected during the field examination. All samples were analyzed for copper, molybdenum, and tungsten; copper and molybdenum were analyzed by atomic absorption spectrophotometry (AA) and tungsten was analyzed colorimetrically. Twenty-one mine and prospect samples were fire-assayed for gold and silver and 4 were analyzed by semiquantitative optical-emission spectrography for 40 elements (see appendix for results and list of elements and detection limits).

Analyses were performed by the Bureau Research Center at Reno, Nevada, and by Barringer Resources, Inc., of Golden, Colorado. Mineral resource classifications used in this report follow definitions in USGS Circular 831 (U.S. Bureau of Mines and U.S. Geological Survey, 1980).

Geologic setting

The Coyote Mountains are a metamorphic core complex of Late Cretaceous-Early Tertiary-age granite intruded into Jurassic-age plutonic rocks and

Paleozoic-age metasediments. The Pan Tak Granite consists of two phases and is dated at 58 ± 3 m.y.b.p. In the southern part of the area, the Jurassic plutonic rocks are hornblende- and(or) biotite-bearing granodiorite, monzonite and monzogranite, and syenogranite. In the northeast part of the area, the Jurassic rocks are sphene- and epidote-bearing hornblende-biotite quartz diorite, hornblende-epidote diorite, and augite hornblendite. (Wright and Haxel, 1982).

The Paleozoic metasediments, found in the granitic rocks as small roof pendants of quartzite and more common calc-silicate schist, are in a mile-wide, north-trending zone which includes the only mining camp in the area, Cavillo Camp (fig. 2).

Evidence for the Coyote Mountains being a metamorphic core complex includes mylonitized rocks and chloritic breccia underlying the Ajo Road Fault, or decollement, which lies to the north of the study area, as described by Gardulski (1980).

Mining activity

The majority of the mining activity has taken place in the Cavillo Camp (or Bonanza Mine) area (fig. 2), within the study area at the head of the north fork of Mendoza Canyon. Twenty unpatented mining claims, owned by Clyde Caviness of Tucson, cover the workings of the Cavillo Camp area (pl. 1). Published information indicates that the Bonanza Mine produced about 700 tons of ore averaging 10% copper, 0.03 oz gold/st, and 1.7 oz silver/st between 1909 and 1951 (Keith, 1974). Although no other production has been recorded, copper mineralization is exposed along rock contacts and/or shear zones in several nearby adits. In 1967, nine holes were diamond-drilled for Consolidated Red Poplar Minerals Ltd., of Canada, in the Cavillo Camp area.

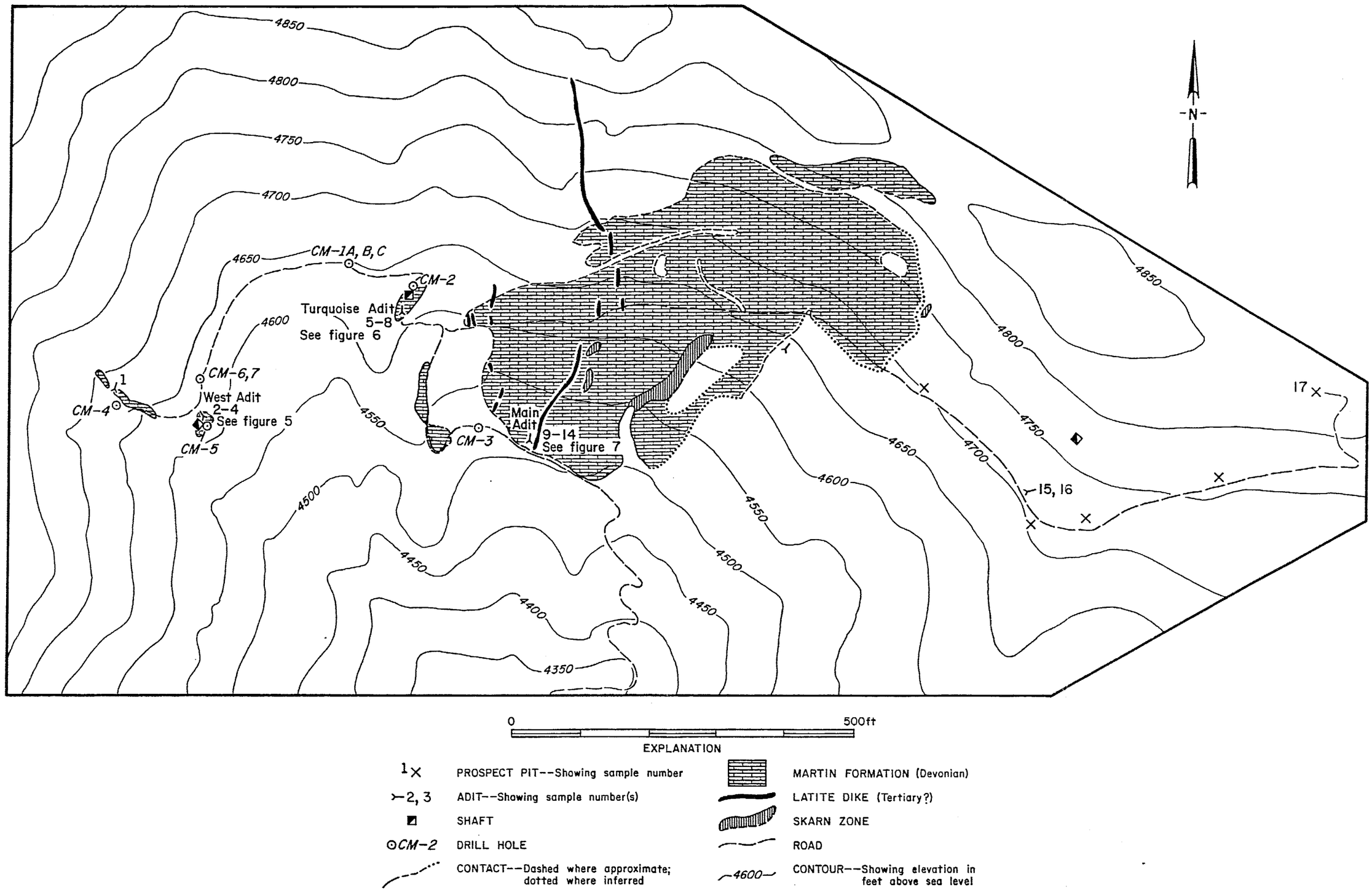


Figure 2.--Cavillo Camp area, showing workings, Martin Formation exposures, and sample localities 1-17 (geology after Carrigan, 1971).

Previous mining activity also includes several small prospect pits and an adit on the Papago Indian Reservation about 1 1/4 mi north of Cavillo Camp (pl. 1).

No oil or gas leases are recorded within 1 mi of the WSA boundary and, according to Ryder (1983), the WSA has no potential for oil and gas because of the preponderance of plutonic and gneissic rocks.

APPRAISAL OF SITES EXAMINED

The majority of the surface and underground workings within the WSA are in the Cavillo Camp area. Drilling records for this area provided geologic information and sub-surface assay data for correlation with these workings. A short adit and four prospect pits in the eastern part of the Cavillo Camp area were examined but not sampled because of obvious lack of mineral occurrence and alteration.

Cavillo Camp area

Copper, tungsten, and minor amounts of precious metals were mined at Cavillo Camp in the northeast part of the WSA. Surface cuts and underground workings were dug on contact metamorphic deposits at the margins of, and partially replacing, impure limestone and limey sedimentary blocks, probably roof pendants, in a granitic intrusive mass.

The copper occurrences are in the Devonian-age Martin Formation, a marbleized, dolomitic limestone (Carrigan, 1971). Skarn zones, where the Martin Formation has been strongly marbleized and converted to assemblages of epidote, garnet, and diopside, contain scheelite (calcium tungstate), minor amounts of precious metals, and copper minerals (oxidized near the surface). Mineral occurrences were mined or explored at nine adits and inclines and five prospect pits (fig. 2). Seventeen chip and dump samples were collected from the workings by Bureau personnel. Samples 8 and 10 each assayed 0.05 oz

gold/st; the remainder of the samples assayed from nil to 0.01 oz gold/st. Silver assayed as much as 3.9 oz/st, with most of the assays below 0.7 oz/st. Copper assayed from 0.0166% to 7.2%, averaging about 2% in most of the mineralized parts of the workings. Tungsten content, not necessarily correlative with copper content, ranged from 0 to 0.504% tungsten trioxide (WO_3), with 12 of the 17 samples assaying greater than 0.100%. Molybdenum content was very low; the highest concentration was 0.0688% (sample no. 4), with most of the assays averaging about 0.005% (table 1). Drill holes near the underground workings, however, contained considerably greater metal concentrations, with intercepts ranging to 11.8% copper and 5.99 oz silver/st (figs. 3 and 4).

West Adit area

More than 400 ft of underground workings are in and at the edges of the Martin Formation (figs. 2-7).

Assays of four samples collected by Bureau personnel from the accessible portions of two adits yielded weighted averages of 0.01 oz gold/st, 0.4 oz silver/st, 2.60% copper, 0.163% WO_3, and 0.019% molybdenum (fig. 5). Weighted averages of core assays from three diamond-drill holes (CM-4, 5, and 7) gave results of 3.1 oz silver/st and 4.87% copper over an average of 16 ft of vertical thickness and an area of 200 ft by 225 ft (table 1; figs. 3 and 4).

Based on these data and a density of 9.2 cu ft/t for the mineralized rock, a resource of about 55,000 tons averaging in excess of 2 oz silver/st, 4% copper, and 0.16% WO_3 can be identified, assuming that the mineralized zone is continuous between the drill holes.

Drill hole intercepts (fig. 4) from the Consolidated Red Poplar Minerals drilling indicates that there are mineralized zones below the calculated

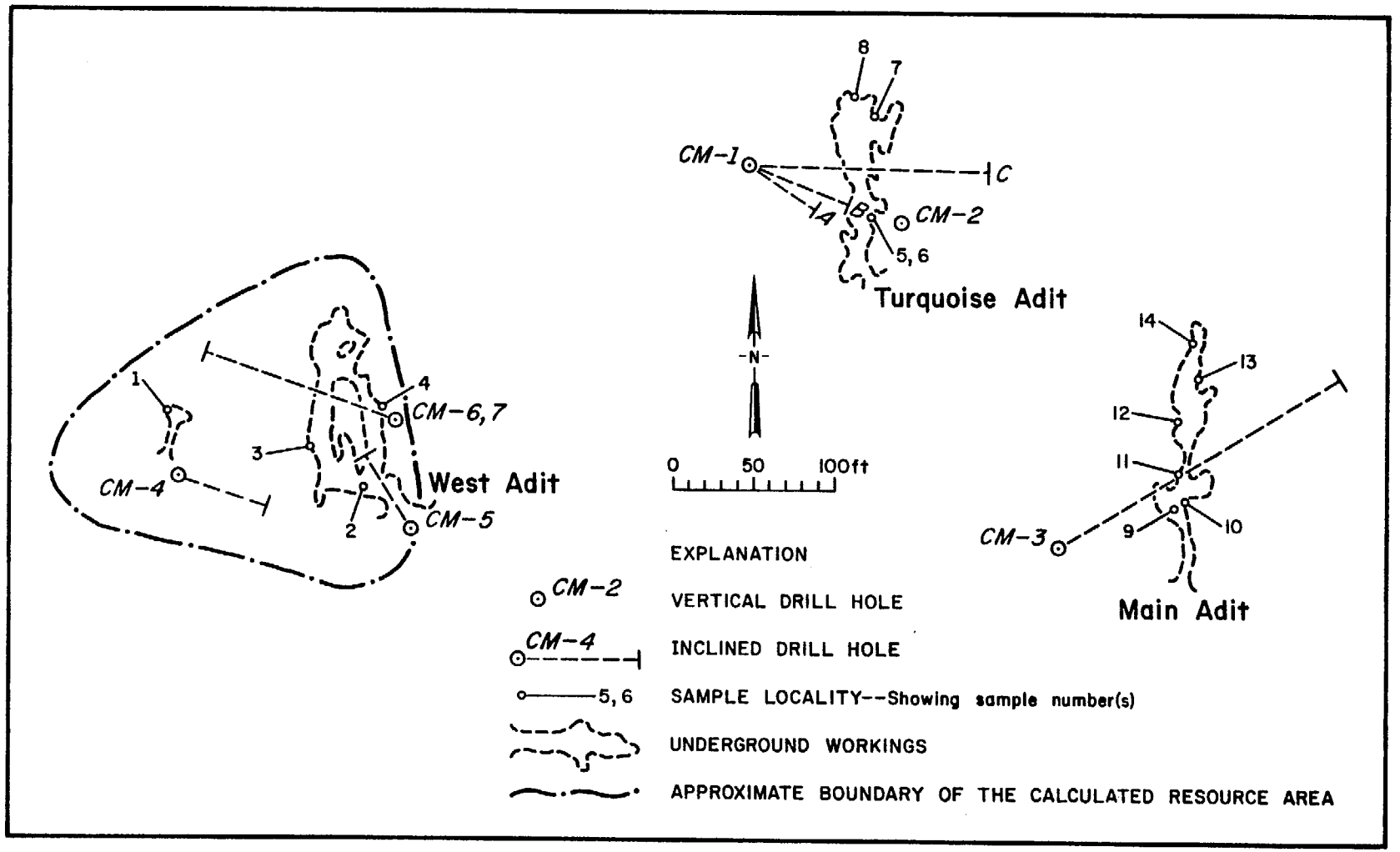


Figure 3.--Plan of drill holes CM-1 to CM-7, showing underground workings, sample localities, and outline of calculated resource in West Adit area.

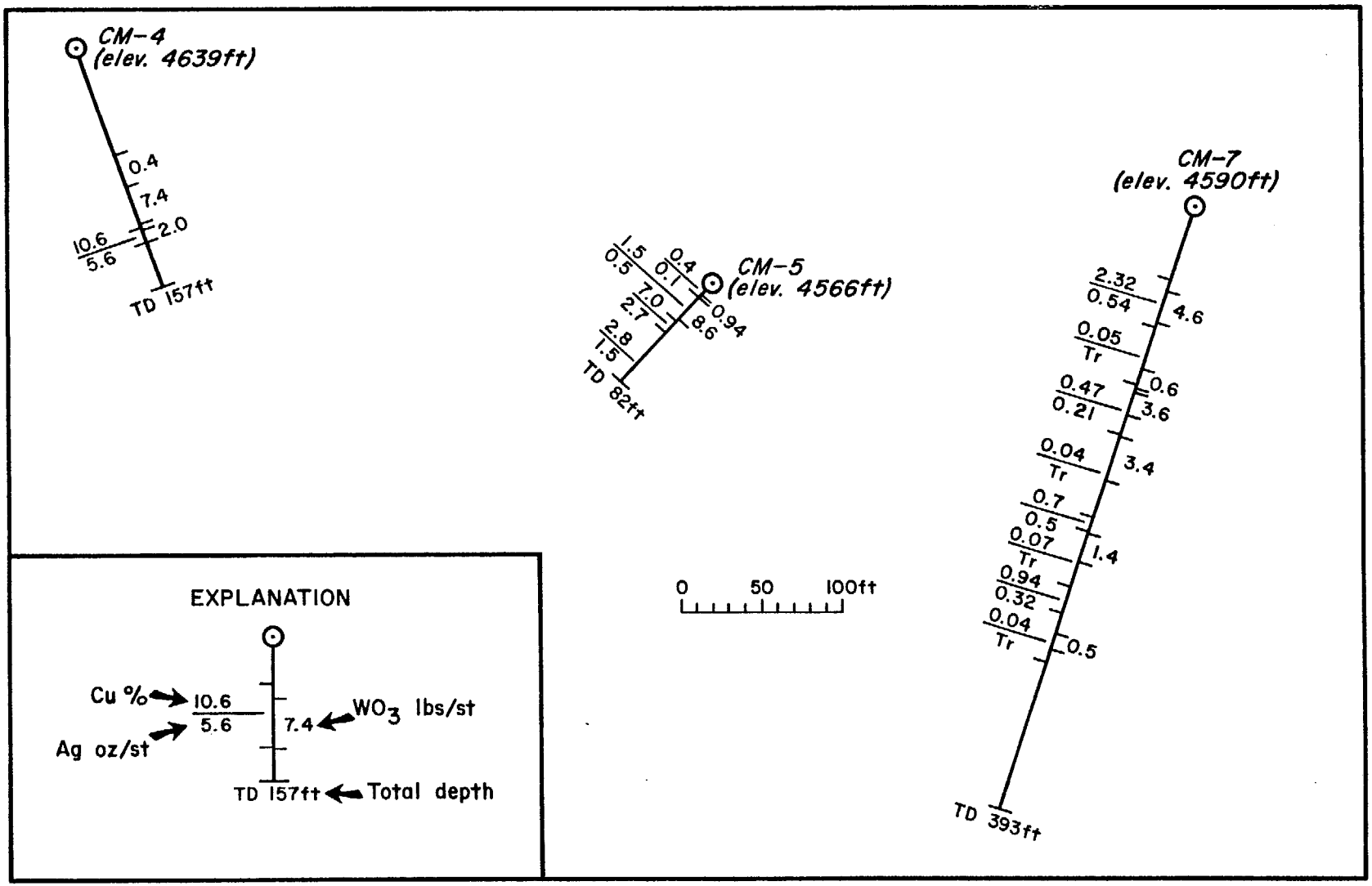
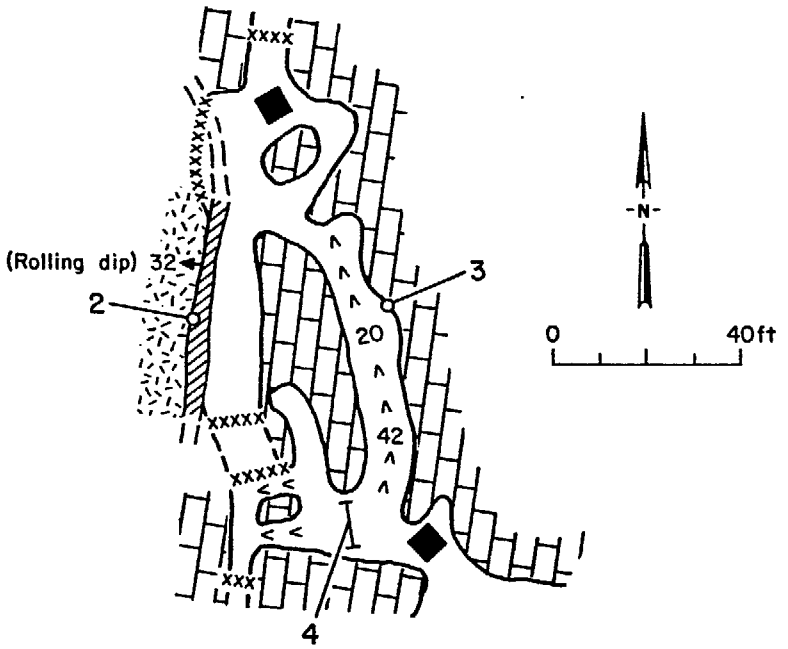
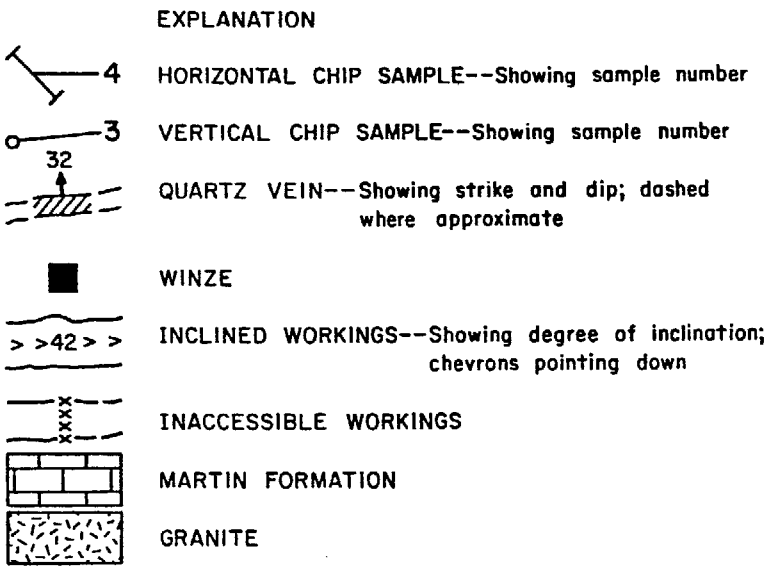


Figure 4.--West Adit area, cross-sections of drill holes CM-4, 5, and 7, showing assay values.





[Gold and silver determined by fire assay; detection limits are 0.005 oz Au/st and 0.05 oz Ag/st. Copper and molybdenum determined by AA; detection limits are 1 ppm Cu and 2 ppm Mo. Tungsten determined colorimetrically; detection limit is 4 ppm. Symbols used: ---, not detected.]

Sample			Analytical data					Description and remarks
No.	Type	Length (ft)	Au	Ag	Cu	Mo	WO_3	
			oz/st		percent			
1	chip	3.0	0.01	0.7	4.3	0.0688	0.04	Granite; abundant limonite and copper-oxide stain, some chrysocolla (see fig. 2 for sample location).
2	do.	6.0	.01	.4	2.52	.004	.353	Rolling contact zone, metasediments below, granite above; sample across 3 ft biotite gneiss with 1.5 ft limonite and minor azurite and malachite above and 1.5 ft limonite and minor malachite below.
3	do.	2.0	.01	---	2.61	.0192	.101	Rolling contact zone; approximately 2 ft vuggy zone with chrysocolla and moderate amount of limonite.
4	do.	9.0	.01	.4	2.04	.0048	.176	Along contact zone at back; moderate amount of brown limonite, azurite, chrysocolla, and malachite (?).

Figure 5.--West Adit, showing sample localities 2-4; table shows sample data.

resource of 55,000 tons. However, because no three-dimensional information is available, further work would be required to delineate tonnages and grades of the deeper mineralized zones.

Turquoise Adit

The Turquoise Adit consists of a 102-ft-long adit along a granite-Martin Formation contact (fig. 6). One diamond-drill hole (CM-2) was located about 20 ft north of a raise and three attempts (CM-1A, 1B, and 1C) were made to obtain diamond drill core from a site about 100 ft west-northwest of the portal of the adit (figs. 2 and 3).

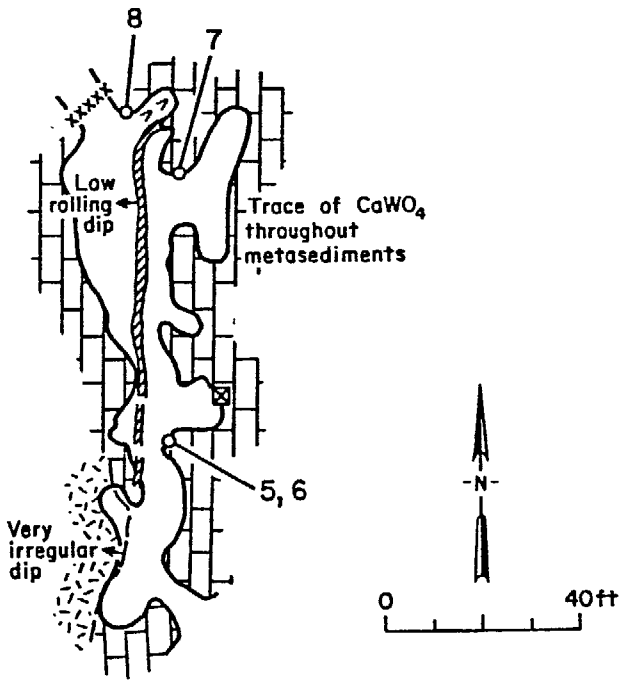
Assays from the Bureau sampling (four samples) indicated an average of 0.02 oz gold/st, 0.6 oz silver/st, 2.06% copper, and 0.171% WO_3 across a sampled thickness of 2.8 ft. Drill hole CM-2 showed a mineralized thickness of 13 ft and assays of 5.99 oz silver/st, 11.8% copper, 0.187% WO_3, and 0.025% molybdenum (table 1; fig. 4).

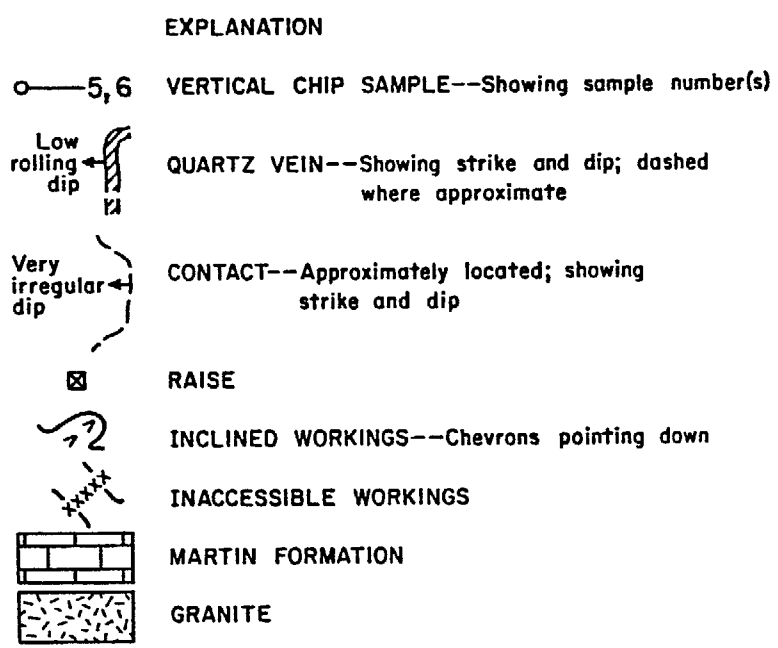
Assuming a thickness of about 8 ft, (averaging Bureau sampling and the drill hole CM-2 intercept), a resource of approximately 7,500 tons, containing from 2% to 11% copper, 0.15% to 0.20% WO_3, and small amounts of gold, silver, and molybdenum, is present over an area of about 100 ft by 110 ft.

Main Adit

Development work done at the Main Adit included a 140-ft-long adit along the granite-Martin Formation contact and a diamond drill hole which penetrated the rock below the adit (figs. 2, 3, and 7).

Bureau personnel collected six samples from the adit. Weighted assay averages along the adit were a trace of gold, 0.52 oz silver/st, 1.54% copper, and 0.188% WO_3. However, most of the mineral concentrations were in the





[Gold and silver determined by fire assay; detection limits are 0.005 oz Au/st and 0.05 oz Ag/st. Copper and molybdenum determined by AA; detection limits are 1 ppm Cu and 2 ppm Mo. Tungsten determined colorimetrically; detection limit is 4 ppm.]

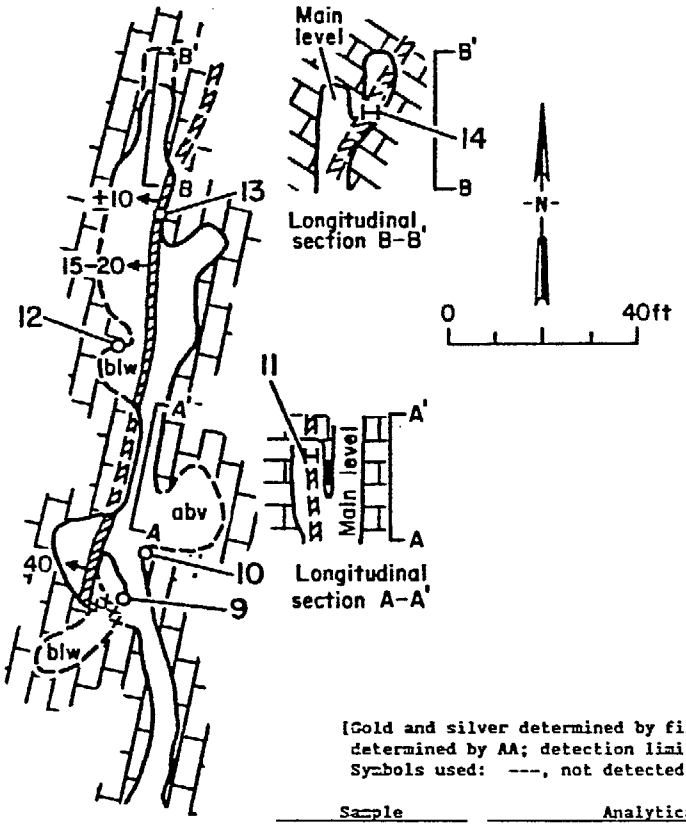
Sample			Analytical data					
No.	Type	Length (ft)	Au	Ag	Cu	Mo	WO_3	Description and remarks
			oz/st		percent			
5	chip	1.2	0.05	1.1	4.7	0.0036	0.202	Below granite contact; 2 in. chrysocolla, 0.5 in. hematite, minor chrysocolla "soaking" 9 in. altered, clayey rock, and 2 in. chrysocolla (at top).
6	do.	2.2	.01	.2	.67	.0084	.176	Below sample 8; 2.2 ft abundant hematite and biotite with 0.8 ft marble at center; minor chrysocolla.
7	do.	2.0	.05	1.0	1.72	.0036	.151	Two ft hematite, limonite stain, chrysocolla, and minor azurite.
8	do.	2.0	.01	.3	4.1	.0092	.013	Marbleized, abundant calcite.

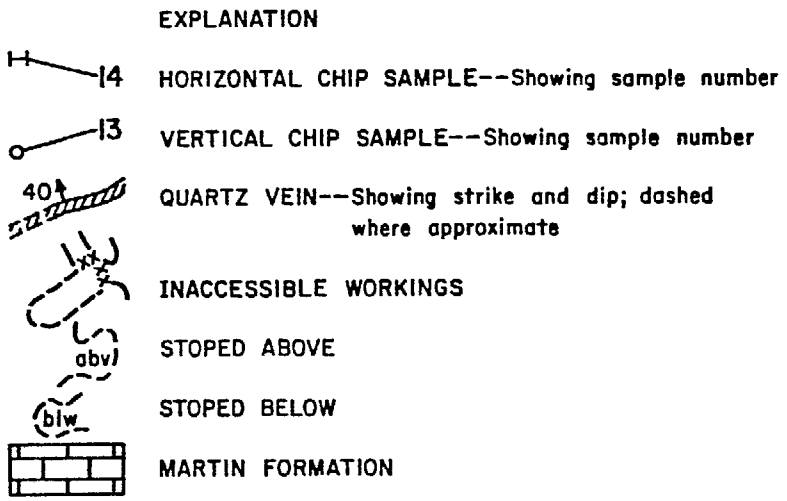
Figure 6.--Turquoise Adit, showing sample localities 5-8; table shows sample data.

Table 1.--Summary of drill hole logs (copy of Consolidated Red Poplar Minerals data).

DIAMOND DRILL HOLE SUMMARY
Consolidated Red Poplar Minerals, Ltd.

DDH #	Bearing	Dip	Length (ft)	Remarks
CM-1A	123°	-45°	68	Unable to hold water or cement.
CM-1B	113°	-50°	96	Losing water, unable to hold cement.
CM-1C	Due E.	-50°	224	Core barrel broken off in hole; abandoned.
CM-2		-90°	56	13 ft of 11.8% Cu, 5.99 oz Ag/st, 3.73 lb WO_3/st, 0.5 lb Mo/st.
CM-3	058°	-50°	308	Scattered copper mineralization throughout (oxides and sulfides).
CM-4	108°	-70°	157	11.0 ft of 10.57% Cu, 5.58 oz Ag/st; West Adit zone; 118 ft-129 ft, 11 ft true.
CM-5	324°	-47°	82	Stopped at fault zone; 80 ft of 2.52% Cu, 1.16 oz Ag/st; 35 ft to 80 ft, 20 ft thick true of 3.9% Cu, 1.66 oz Ag/st; West Adit zone.
CM-6	288°	-52°	61	Stopped in badly broken ground; last 8.0 ft in copper mineralization; West Adit zone.
CM-7	288°	-72°	393	216 ft of 0.53% Cu, 0.07 oz Ag/st; 55 ft to 80 ft, 17 ft thick true of 2.32% Cu--some high-grade sections.
HG-1	130°	-60°	291	Scattered copper mineralization throughout.
HG-2	028°	-60°	197	46 ft of 3.34% Cu, 2.87 oz Ag/st.





[Gold and silver determined by fire assay; detection limits are 0.005 oz Au/st and 0.05 oz Ag/st. Copper and molybdenum determined by AA; detection limits are 1 ppm Cu and 2 ppm Mo. Tungsten determined colorimetrically; detection limit is 4 ppm. Symbols used: ---, not detected; Tr., trace.]

Sample			Analytical data					
No.	Type	Length (ft)	Au	Ag	Cu	Mo	WO_3	Description and remarks
			oz/st		percent			
9	chip	3.0	---	0.1	2.2	0.0052	0.252	Zone of abundant biotite with disseminated scheelite and seams of malachite.
10	do.	2.0	Tr	3.9	7.2	.006	.504	Zone of abundant biotite with disseminated scheelite and seams of malachite; moderate amount of scheelite visible.
11	do.	2.7	---	---	.28	.0024	.429	Zone of abundant biotite with disseminated scheelite and seams of malachite; visible scheelite.
12	do.	3.0	Tr	.1	.095	.0012	.035	Zone of abundant biotite with disseminated scheelite and seams of malachite; copper and scheelite less plentiful.
13	do.	2.5	0.01	.4	2.24	.0024	.071	Zone of abundant biotite with disseminated scheelite and seams of malachite; visible oxidized copper minerals and scheelite.
14	do.	3.0	---	---	.017	.0044	.353	Zone of abundant biotite with disseminated scheelite and seams of malachite; metamorphism increases, 3 ft abundant scheelite.

Figure 7.--Main Adit, showing sample localities 9-14; table shows sample data.

first 50 ft of the adit, averaging a trace of gold, 1.06 oz silver/st, 2.56% copper, and 0.398% WO_3 (fig. 7). Diamond drill hole CM-3 encountered scattered copper mineralization throughout its length (table 1), but rock types encountered and assays are unknown, therefore no projection of resources at depth can be made.

Total resource of mineralized rock present is about 4,000 tons if an average mineralized thickness of 2.7 ft is assumed (based on Bureau samples) and the entire adit length is included in the calculation. If only the first 50 ft of the adit is the basis for the tonnage calculation, about 1,750 tons can be defined.

South prospect area

A decline, a prospect pit, and two drill holes (HG-1 and HG-2) are located near a skarn zone at the contact between granitic rock and the Martin Formation, about 1,900 ft south of the West Adit area (pl. 1).

Drill hole information (table 1) and sample 20 (table 2), collected from the top of a 35-ft-deep decline, indicate that copper minerals occur at or near the contact. Sample 20 gave assays of 1.65% copper and 0.2 oz silver/st; no significant gold, tungsten, or molybdenum was detected. Drill hole HG-2, which angled northeast toward the contact, intercepted 46 ft assaying 3.34% copper and 2.87 oz silver/st; drill hole HG-1, which angled southeast, showed only scattered copper concentrations throughout (no assays available; table 1).

Because of the limited information, no resource was delineated in this area. However, the length of intercept and concentrations encountered in drill hole HG-2 indicate that additional drilling is warranted to determine if a copper-silver resource is present.

Table 2.--Data for samples 15-21.

[Gold and silver determined by fire assay; detection limits are 0.005 oz Au/st and 0.05 oz Ag/st. Copper and molybdenum determined by AA; detection limits are 1 ppm Cu and 2 ppm Mo. Tungsten determined colorimetrically; detection limit is 4 ppm. Symbols used: xx, not applicable; ---, not detected; Tr, trace; <, less than given value.]

Sample			Analytical data					Description and remarks
No.	Type	Length (ft)	Au	Ag	Cu	Mo	WO_3	
			oz/st		percent			
15	select	xx	---	0.4	4.00	0.0016	0.151	Marbleized limestone; massive hematite with chrysocolla and malachite, minor tenorite (?).
16	chip	5.5	---	.2	.54	.0012	.01	Metasediments; irregular minor chrysocolla, malachite, and azurite along fractures and bedding planes.
17	dump	xx	0.01	.5	2.87	.002	.126	Biotite schist, contact with granite; skarn zone, north strike, 45° W. dip, abundant epidote and tan to maroon limonite; moderate copper oxides (mostly chrysocolla) on fractures and along bedding.
18	chip	2.0	---	.1	.094	.0204	.003	Metasediments, granite above and below sedimentary block; bedding-plane fault strikes N. 10° W., 42° SW. dip; abundant limonite stain and epidote; quartz common.
19	do.	2.0	---	.2	.106	.0044	.001	Metasediments; abundant white marble; some dark limonite stain.
20	do.	1.2	Tr	.2	1.65	<.0002	<.0005	Granite; 1.2 ft fault strikes north-south, 65° W. dip, biotite in fault zone; abundant limonite and malachite stain.
21	do.	3.0	---	.1	.078	<.0002	.0005	Granite (sample 125 ft from portal); quartzy, intensely sericitized, minor chrysocolla.

One drill hole (CM-8) was drilled about midway between this south prospect area and the West Adit area (pl. 1), but information regarding this hole was not available.

North prospect area

A 27-ft-long adit along a weak bedding-plane fault in a metasedimentary block is about 2,000 ft northeast of the Main Adit. Samples 18 and 19 were collected from marbleized, epidotized, and pyritized metasediments in the adit (pl. 1).

About 0.1% copper was present, as were traces of molybdenum, tungsten, and silver; no gold was detected (table 2). Because of the low concentrations encountered, no resource was determined to be present.

Miscellaneous occurrences and sampling

Papago Indian Reservation

Two areas about 6,000 ft north of the Cavillo Camp area (3,000 ft north of the Papago Indian Reservation boundary) were examined, and it was ascertained that the copper occurrences in several small prospect pits and an adit are at granite-limestone contacts, similar to those in the WSA.

Stream-sediment sampling

Thirteen minus-80-mesh stream-sediment samples were collected from selected drainages to determine if mineralized rock extended for any appreciable distances beyond the surface exposures, thereby aiding in the resource assessment of the mineral occurrences sampled within the WSA (pl. 1).

Analyses of the stream sediments (table 3) averaged about 30 ppm copper and 3 ppm molybdenum, the maximum assays being 167 ppm and 10 ppm, respectively. Tungsten was below the detection limits of the assay procedure,

Table 3.--Data for minus-80-mesh stream-sediment samples 22-34.

[Copper and molybdenum determined by AA; detection limits are 1 ppm Cu and 2 ppm Mo. Tungsten determined colorimetrically; detection limit is 4 ppm. Symbols used: <, less than given value.]

Sample no.	Analytical data (ppm)		
	Cu	Mo	W
22	83	4	<4
23	167	10	<4
24	49	8	<4
25	16	<2	<4
26	26	<2	<4
27	50	6	<4
28	30	6	<4
29	35	<2	<4
30	33	<2	<4
31	14	8	<4
32	25	2	<4
33	27	<2	<4
34	12	2	<4

less than 4 ppm. No major near-surface source for copper, molybdenum, or tungsten was indicated within the WSA.

Industrial minerals

Most of the WSA is devoid of sand or gravel cover. Gravel for road-building and similar uses is readily available outside of the study area.

The sedimentary rocks present generally are impure and metamorphosed limestones and of such limited quantity that no limestone resource is present.

CONCLUSIONS

Copper, tungsten, and silver resources are found in the eastern part of the WSA and generally are confined to skarn or altered zones that border, or occur in, metamorphosed sedimentary roof pendants in granitic rock.

Total resources at the copper, tungsten, and silver occurrences cannot be calculated accurately because (1) of the great variability in mineral content, (2) the drill holes indicate a considerably greater thickness of the mineralized zones than are exposed by the accessible underground workings, and (3) assay results of the drill cores generally are much greater than the sampling assays from the adits. In the drill hole intercepts, copper content is as much as 12%, the maximum silver value is 5.99 oz/st, and tungsten content is as much as 0.43% WO_3 (not all intervals assayed); in the underground workings, copper averages about 2.5%, silver about 1 oz/st, and WO_3 about 0.15%.

The total resource in the WSA is estimated to be a minimum of 66,500 tons of mineralized rock if the assumptions are made that drill hole sampling and assays are accurate and the mineralized zones are continuous between the drill holes and/or underground workings. If these assumptions are correct, the

copper grade of the resource will be in excess of 5%, the silver more than 1.5 oz/st, and the WO_3 from 0.15% to 0.20% for the entire tonnage.

Development work thus far done in the area of Cavillo Camp has been limited to mining and exploration on outcrops that show evidence of possible economic mineralization. Additional exploration work in the vicinity of the Martin Formation blocks mapped in this area might identify additional resources. The work could include inexpensive geophysical techniques, such as self-potential surveys to detect zones of oxidizing sulfides, and limited drilling to test the concealed portions of the Martin Formation.

Weak metal concentrations, chiefly copper, are found in the intrusive granite, they are too low to be of economic significance.

No resources of industrial minerals, including sand, gravel, or limestone, are present within the WSA.

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Appendix--Dectection limits and results of Semiquantative optical emission spectrographic analysis.

Element	Detection limit (percent)	Element	Detection limit (percent)
Ag	0.002	Mo	0.0001
Al	.001	Na	.3
As	.01	Nb	.007
Au	.002	Ni	.0005
B	.003	P	.7
Ba	.002	Pb	.001
Be	.0001	Pt	.0001
Bi	.01	Sb	.06
Ca	.05	Sc	.0004
Cd	.0005	Si	.0006
Co	.001	Sn	.001
Cr	.0003	Sr	.0001
Cu	.0006	Ta	.02
Fe	.0006	Te	.04
Ga	.0002	Ti	.03
K	2.0	V	.005
La	.01	Y	.0009
Li	.002	Zn	.0001
Mg	.0001	Zr	.003
Mn	.001		

These detection limits represent an ideal situation. In actual analyses, the detection limits vary with the composition of the material analyzed. These numbers are to be used only as a guide.

Results of semiquantitative optical emission spectrographic analyses.

Elements	Sample Numbers 4	9	14	16
	Concentration, percent			
Ag	<.0005	<.0007	0.03	<0.006
Al	1.	>2.	.8	>3.
As	<.009	<.009	.05	<.009
Au	<.002	<.002	<.002	<.002
B	<.003	<.004	.01	<.004
Ba	.002	<.002	.05	.007
Be	.002	.0008	.0005	.003
Bi	<.01	<.01	.06	<.01
Ca	<.05	3.	.2	10.
Cd	<.0005	<.0005	<.0005	<.0005
Co	<.001	<.001	.01	<.001
Cr	<.0003	<.0003	.001	<.0003
Cu	>10.	.2	10.	.06
Fe	8.	10.	10.	9.
Ga	<.0002	<.0006	.009	.003
K	9.	>10.	8.	7.
La	<.01	<.01	<.01	<.01
Li	<.002	.01	.01	<.004
Mg	.6	2.	1.	.1
Mn	>1.	>3.	>.1	>5.
Mo	<.0001	<.0001	<.0001	<.0001
Na	<.3	<.3	<.3	<.3
Nb	<.007	<.007	<.007	<.01
Ni	<.001	<.0006	.003	<.0003
P	<.7	<.7	<.9	<1.
Pb	<.002	<.002	<.002	<.002
Pd	<.0001	<.0001	<.0001	<.0001
Pt	<.0006	<.0006	.003	<.0006
Sb	<.1	<.06	<.1	<.06
Sc	<.0004	<.0004	<.0004	<.0004
Si	>10.	5.	4.	>10.
Sn	<.003	<.01	.02	<.03
Sr	.0002	<.0001	<.0001	.0007
Ta	<.02	<.02	<.02	<.02
Te	<.04	<.04	<.04	<.04
Ti	<.03	<.03	.1	<.07
V	<.005	<.005	.05	<.005
Y	<.001	<.001	<.001	<.001
Zn	.03	.04	.02	.06
Zr	<.003	<.003	.02	<.003

DEPARTMENT OF THE INTERIOR
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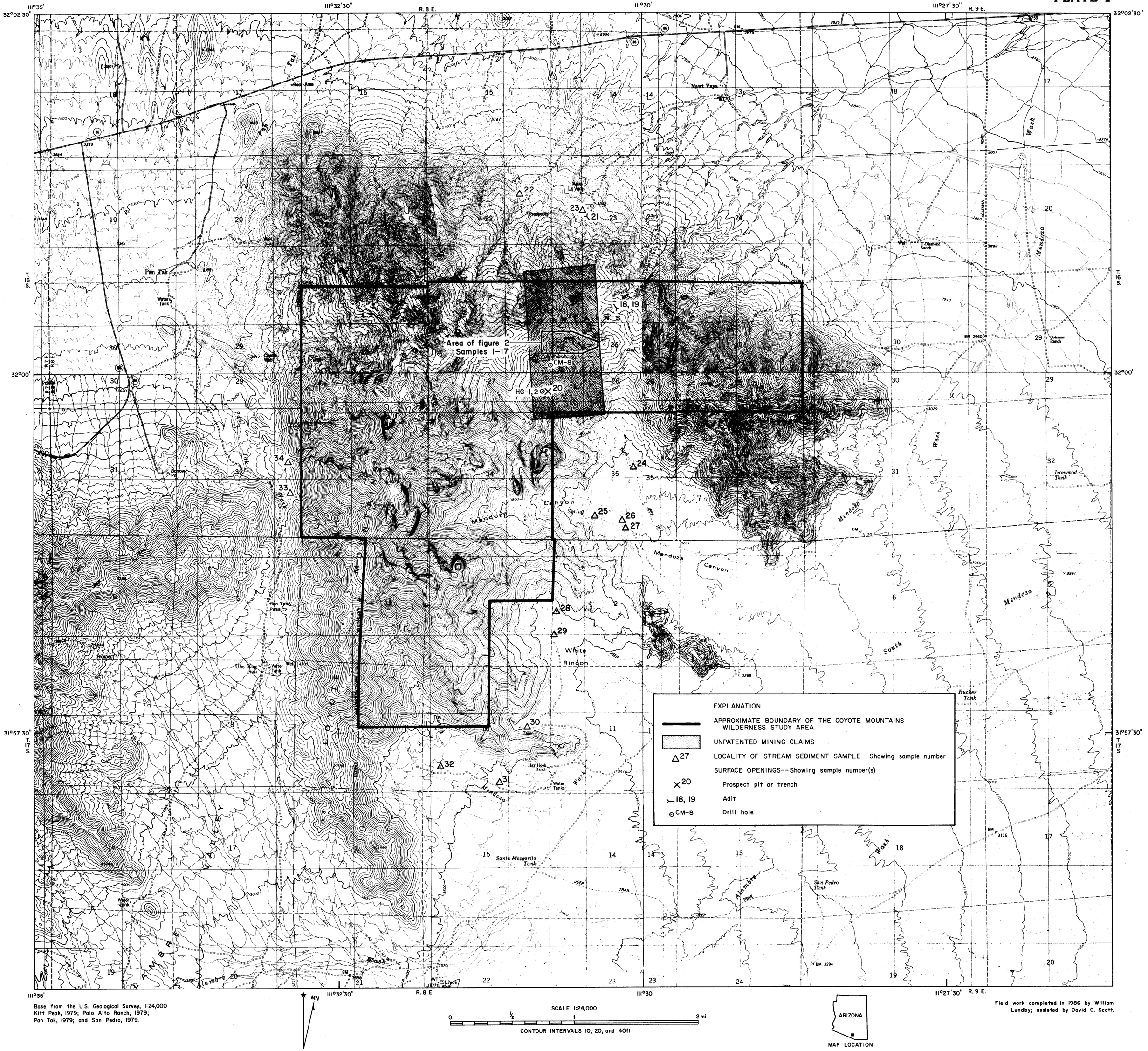
MLA 34-87
PLATE 1



Base from the U.S. Geological Survey, 1:24,000
Kitt Peak, 1979; Palo Alto Ranch, 1979;
Pan Tak, 1979; and San Pedro, 1979.

Field work completed in 1986 by William Lundby; assisted by David C. Scott.

MINE AND PROSPECT MAP OF THE COYOTE MOUNTAINS WILDERNESS STUDY AREA, PIMA COUNTY, ARIZONA

BY

WILLIAM LUNDBY, U.S. BUREAU OF MINES

1987